



## Textile Production in Early Helladic Tiryns

Siennicka, Malgorzata

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# **KOSMOS**

## **JEWELLERY, ADORNMENT AND TEXTILES IN THE AEGEAN BRONZE AGE**

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## TEXTILE PRODUCTION IN EARLY HELLADIC TIRYNS\*

Tiryns is a prehistoric site in Greece especially well known for the Mycenaean period occupation, but already in the Early Helladic (EH) II–III periods (c. 2800–2000 BC)<sup>1</sup> the settlement had played an important role in the Argolid. Both in the upper and lower part of the acropolis a number of domestic buildings were uncovered, dating from successive sub-phases of the EH II–III period (Pl. XXIV). From the EH layers, various objects identified as textile tools were revealed. Potential spindle whorls and loom weights from EH Tiryns will be presented in the following contribution, and the archaeological context of the finds will be outlined. Finally, the possible employment of plant and animal fibres will be briefly discussed in relationship to the textile tools.

### Introduction to the site in the Early Helladic period

Tiryns is one of the most thoroughly investigated and published prehistoric sites in the Argolid, especially as far as the Mycenaean finds are concerned.<sup>2</sup> On the upper acropolis, remains of a monumental Circular Building of unknown functions, the so-called *Rundbau*, as well as other buildings were uncovered (Pl. XXIV, A–E).<sup>3</sup> More EH architectural remains were unearthed on the lower acropolis. Already Heinrich Schliemann in the 19th century came across some clay cylinders with double perforations which he interpreted as loom weights and which are dated today to the EH period.<sup>4</sup> Prior to excavations conducted in the 1970–

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\* I wish to thank Prof. Marie-Louise Nosch and Prof. Robert Laffineur for inviting me to participate in the KOSMOS conference. I thank the participants for their comments on my paper. I would also like to express my gratitude to Prof. Joseph Maran, the director of the Tiryns excavations, for granting me permission for research on the Early Helladic textile tools from Tiryns. A grant from the University of Warsaw provided me with an opportunity to carry out a preliminary study of the textile tools at Tiryns. I am grateful to Dr. Lorenz Rahmstorf for his advice, especially on the crescent-shaped objects. Paul Barford kindly improved my English text. The EH and Mycenaean textile tools from Tiryns were recorded by Dr. Lorenz Rahmstorf and myself in 2008 in the database of the Danish National Research Foundation's Centre for Textile Research (CTR) within "Tools and Textiles – Texts and Contexts Research Program". Some of the results of the CTR investigations are referred to in the present study. Preliminary observations on the Bronze Age textile tools from Tiryns will be published in L. RAHMSTORF, M. SIENNICKA and E. ANDERSSON, "Textile Tools at Tiryns," in E. ANDERSON and M.-L. NOSCH (eds), *Tools, Textiles and Contexts. Investigations of Textile Production in the Bronze Age Eastern Mediterranean* (forthcoming).

1 J. MARAN, *Kulturwandel auf dem griechischen Festland und den Kykladen im späten 3. Jahrtausend v. Ch. Studien zu den kulturellen Verhältnissen in Südosteuropa und dem zentralen sowie östlichen Mittelmeerraum in der späten Kupfer- und frühen Bronzezeit* (Universitätsforschungen zur prähistorischen Archäologie 53, 1998) pl. 80; see also S.W. MANNING, *The Absolute Chronology of the Aegean Early Bronze Age. Archaeology, Radiocarbon and History* (Monographs in Mediterranean Archaeology 1, 1995) fig. 1–2.

2 On the history of the excavations at Tiryns see: L. RAHMSTORF, *Kleinfunde aus Tiryns. Terrakotta, Stein, Bein und Glas/Fayence vornehmlich der späten Bronzezeit* (Tiryns XVI. Berichte und Forschungen, 2008) 6–11.

3 K. MÜLLER, *Die Architektur der Burg und des Palastes* (1930) 80–115, pl. 5–6a; K. KILIAN, "The Circular Building at Tiryns," in R. HÄGG and D. KONSOLA (eds), *Early Helladic Architecture and Urbanization. Proceedings of a Seminar Held at the Swedish Institute in Athens, June 8, 1985* (1986) 65–71; P. MARZOLFF, "Der frühbronzezeitliche Rundbau von Tiryns. Architektonischer Einzelgänger oder Aussenposten einer östlichen Koine?," in *Bronze Age Architectural Traditions in the Eastern Mediterranean: Diffusion and Diversity/Architektonische Traditionen im Östlichen Mittelmeer während der Bronzezeit: Verbreitung und Vielfalt* (2009) 185–193, fig. 1–22; see also J. MARAN, "Tiryns – Mauern und Paläste für namenlose Herrscher," in K. RHEIDT *et al.* (eds), *Archäologische Entdeckungen. Die Forschungen des Deutschen Archäologischen Instituts im 20. Jahrhundert* (2000) fig. 134.

4 H. SCHLIEHMANN, *Tiryns: Der Prähistorische Palast der Könige von Tiryns; Ergebnisse der neuesten Ausgrabungen* (1886) 165–166, fig. 71.

1980s by Klaus Kilian relatively few EH remains had been uncovered on the lower acropolis.<sup>5</sup> The investigations of Kilian, however, revealed a number of buildings dating from successive sub-phases of the EH II–III period<sup>6</sup> (squares LXI–LXV/38–41). The finds from these layers form the basis for the present study. EH material has also been excavated in the lower town.<sup>7</sup> The architecture, pottery and a few small finds from various areas of the EH activity have only briefly been mentioned in the preliminary reports,<sup>8</sup> and have never been presented as a final publication. Moreover, no stratigraphical study of the Early Bronze Age layers has been presented until now, which causes a serious difficulty in estimating the precise chronology of the finds from the Early Bronze Age layers.

### Archaeological context of the EH textile tools

It is frequently not clear to which exact sub-phase of the EH period the discussed objects belong. With a preliminary analysis of them, as well as observations of K. Kilian and H.-J. Weisshaar on the EH houses and pottery uncovered on the lower acropolis, only an imprecise dating of the objects can be offered. Yet, it must be emphasised that a further detailed study of the EH stratigraphy, excavation plans and documentation is certainly needed.

It seems that most of the finds connected with textile production from the lower acropolis were employed in residential areas dating to EH II, the transitional phase EH II/III, and EH III. Even if it is not always possible to ascribe the finds to particular buildings or rooms, it can be suggested that they were originally used in houses or in their proximity (e.g. in courtyards or streets, which may be especially true for hand spinning, since this activity did not require a fixed place).

In the early EH layers were found only clay spindle whorls of typical form for the EH period (for the description of particular find groups see below). In one case it seems that four whorls of various sizes (two large and two small)<sup>9</sup> were discovered in the same area, perhaps in Building 202.<sup>10</sup>

From deposits of the developed-late phase of EH II date, a couple of hemispherical spindle whorls, as well as three clay cylinders with two lengthwise perforations were recovered. The objects were found within the same area (LXII 39), but not together. They may have been related to the largest complex of this phase, R 181–186 (Pl. XXIV, F).<sup>11</sup> Two other items seem to originate from the same context, namely fragments of a large conical object and a crescent object.<sup>12</sup> They can be interpreted as loom weights. Other similar objects were found in later layers.

5 H.B. SIEBENTOPF, *Frühelladische Siedlungsschichten auf der Unterburg von Tiryns* (Tiryns V. *Berichte und Forschungen*, 1971) 77–85, fig. 1, pl. 40–41; P. GROSSMAN *et al.*, *Grabungen in den Quadranten IV<sub>2</sub> V. VI<sub>2</sub>* (Tiryns IX. *Berichte und Forschungen*, 1980) 94–97, 102–109, 116–117, pl. 28–31.

6 At Tiryns the stratigraphical system was based by K. Kilian on the successively unearthed archaeological levels, called horizons. The horizons have equivalents in sub-phases of the EH period: early EH – horizon 6; middle EH – horizon 7; late EH – horizon 8; transitional phase EH II/III – horizon 9; EH III – horizon 10. See also H.-J. WEISSHAAR, “Bericht zur Frühelladischen Keramik,” *AA* 1981, fig. 1. On the successive sub-phases at Tiryns see also MARAN (*supra* n. 1) 10–14. On a summary of the EH II and III periods at Tiryns and in Greece see E. ALRAM-STERN, *Die Ägäische Frühzeit Vol. 2. Die Frühbronzezeit in Griechenland. Mit Ausnahme von Kreta* (2004) 156–168, 588–598.

7 There is an EH spindle whorl found on the surface in the lower town (Ti S/W L55/30–94–74 Bef. 105 Streu).

8 K. KILIAN, “Ausgrabungen in Tiryns 1977,” *AA* 1977, 406–409; ID., “Ausgrabungen in Tiryns 1976,” *AA* 1978, 466–467; ID., “Ausgrabungen in Tiryns 1978. 1979,” *AA* 1981, 186–192; WEISSHAAR (*supra* n. 6) 220–256; K. KILIAN, “Ausgrabungen in Tiryns 1980,” *AA* 1982, 420–424, 427–428; H.-J. WEISSHAAR, “Bericht zur Frühelladischen Keramik,” *AA* 1982, 440–466; K. KILIAN, “Ausgrabungen in Tiryns 1981,” *AA* 1983, 314–328; H.-J. WEISSHAAR, “Bericht zur Frühelladischen Keramik. Ausgrabungen in Tiryns 1981,” *AA* 1983, 329–358.

9 Spindle whorls from LXV 38 (Building 202?): LXV 38/62 a1416 XXIII, LXV 38/72 a1412 XXIII, LXV 38/53 a1425 XXII, LXV 38/64 a1425 XXII.

10 KILIAN (*supra* n. 8) 323, 327, fig. 40b.

11 KILIAN (*supra* n. 8) 314, 327, fig. 39b.

12 Clay spindle whorls from LXII 39: LXII 39/87 XIb, LXII 39/57 a1482 VIII; clay cylinders with two perforations: LXII 39/57 a1484 IXb, LXII 39/42 a1472 u Nr. 18, LXII 39/67 VIII; a large clay cone-shaped object: LXII 39/54 VIII; clay crescent-shaped objects: LXII 39/20 VI, (uncertain) LXII 39/76 IXb 2/360.

An interesting group of objects was unearthed in building R 142-144 dated to the transitional phase EH II/EH III (horizon 9).<sup>13</sup> Several clay cylinders with three lengthwise perforations were uncovered in the clearly domestic context of Room 143, very close to a wall.<sup>14</sup> The building to which Room 143 belonged was a large house consisting of three elongated rooms. According to Kilian, the size of the complex was comparable to that of the House of the Tiles at Lerna or the Megaron at Akovitika.<sup>15</sup> Room 143, where the cylinders were preserved, was situated in the central part of the building. It was furnished with a hearth c. 2 m to the north of the concentration of the loom weights. In a corridor-like Room 144, large pithoi were uncovered, while in a trapezoid Room 142 in the north part of the building, another hearth was discovered. In Room 144 of the same building two other potential textile tools seem to have been uncovered: fragments of a large cone and a clay crescent-shaped object. Other fragments of very similar cylinders with three perforations and crescent-shaped objects<sup>16</sup> were discovered in the same area in a slightly lower layer (horizon 8) dated to late EH II. At the moment it is impossible to say whether all these objects were used together. In any case it seems that manufacture of textiles may have taken place in this area. Interestingly, no spindle whorls can be assigned to the layers of building R 142-144.

From horizon 8 or 9 (i.e. EH II or transitional EH II/III), came a group of four small clay cylinders without perforations, which were collected in the same small square (LXIV 38/67).<sup>17</sup> They may have served as loom weights (see below). In the same area were discovered two middle-sized hemispherical spindle whorls. None of these objects can be ascribed to a particular room or building.

Three fragments of crescent-shaped objects and perhaps two spindle whorls may be associated with the EH III strata; no architectural complex can, however, be directly associated with these finds.<sup>18</sup>

### Spindle whorls

The typical EH spindle whorls made of clay are convex or hemispherical.<sup>19</sup> At Tiryns two groups can be distinguished regarding their sizes and shapes. The first group comprises large heavy whorls (diameters of 5-5.4 cm, c. 95-120 g) with shapes rather more conical than

13 KILIAN (*supra* n. 8) 189, fig. 45.

14 Six examples of clay cylinders with three perforations from R 143 have the same number: LXII 39/47 V Nr 11 R. Kilian suggested that a loom was placed in Room 143 (KILIAN [*supra* n. 8] 189). The concentration of the cylindrical objects by the wall is reminiscent of a possible loom from Room 206 of Troy II (C.W. BLEGEN *et al.*, *Troy. General Introduction. The First and Second Settlements* [1950] 350, fig. 333-334, pl. 461). Even if the objects at Tiryns were not found in a row, they obviously formed a group, and were either used or only deposited together. On a similar interpretation of the loom weights found together in a Early Bronze Age House A at Kastanas see: I. ASLANIS, *Kastanas. Ausgrabungen in einem Siedlungshügel der Bronze- und Eisenzeit Makedoniens 1975-1979. Die Frühbronzezeitlichen Funde und Befunde* (1985) 49-51, fig. 23-24.

15 On the House of the Tiles see: M. HEATH WIENCKE, *The Architecture, Stratification, and Pottery of Lerna III. Lerna, a Preclassical Site in the Argolid. Results of Excavations Conducted by The American School of Classical Studies at Athens*. Vol. IV (2000) 213-311; on the Megara at Akovitika see: P.G. THEMELIS, "EH Megaron at Akovitika in Messenia," *AAA* 3 (1970) 303-311; ID., "Early Helladic Monumental Architecture," *AM* 99 (1984) 344-347, fig. 4-5; G.A. PAPATHANASOPOULOS, "Ακοβίτικα," *ArchDelt* 25 (1970) 177-179; M. KOUMOZELIS-BOUCHARD, "The EH II Site of Akovitika in Messenia," *AJA* 85 (1981) 202-203.

16 Cylinders with three perforations from horizon 8: three objects with number LXII 39/47 VI a; a crescent-shaped object probably from horizon 8: LXII 39/20 VI; a large cone-shaped object from horizon 8: LXIII 39/18 VI; a large cone-shaped object from horizon 9: LXII 39/29 Va; a crescent-shaped object from horizon 9: LXII 39/18 c1524.

17 Cylinders without perforations: LXIV 38/67 a1531 XIb, LXIV 38/67 a1531 XIb, LXIV 38/67 a1521 XIc, LXIV 38/67 b1523 XIc.

18 Crescent-shaped objects: LXII 39/59 IV, LXII 39/19 IV, LXII 37/99 IIIb; spindle whorls (uncertain): LXII 38/70 a1552, LXIV 38/64 a1610 V.

19 This type is also called convex-sided, domed: J. CARINGTON SMITH, "Spinning and Weaving Equipment," in W.A. McDONALD and N.C. WILKIE (eds), *Excavations at Nichoria in Southwest Greece. The Bronze Age Occupation* (1992) 682; or standard convex conical: E. BANKS, *The Early and Middle Helladic Small Objects from Lerna* (Ph.D. Dissertation, University of Cincinnati, University Microfilms, 1967), 485-492, 527-528, pl. 16 (convex conical: 1250, 1238).

hemispherical and with flat bases (Pl. XXVa). They are unusually heavy in comparison to the spindle whorls used in Greece during other periods.<sup>20</sup> Until now nine objects from Tiryns have been recorded which date to the early and late phases of EH II and to EH III. To the second group belong middle-sized (diameters of c. 4-4.5 cm, c. 64-73 g) and small whorls (diameters of 2-4 cm, c. 30-40 g) (Pl. XXVb). Only one whorl of unknown date (but possibly EH) is really small and light (diameter 2.1 cm, weight 9.4 g). Small and medium whorls of rounded side profiles had sometimes a hollow at the top. They cover all sub-phases of the EH period, however, most date from EH II. The perforations in all types were vertical and placed centrally. Both large and smaller hemispherical spindle whorls are very characteristic for the EH period and are common at other sites.<sup>21</sup>

Hemispherical whorls were also made of bone, more specifically of the heads of the humerus or femur of large animals (*bovidae*, *cervidae*, *equidae*). From the examples identified in the excavations magazine at Tiryns, only one came from a pure EH context.<sup>22</sup> These nicely polished objects were homogenous in size: they had diameters of c. 4-5 cm, heights of c. 1.7-2.3 cm, and weights of 14-36 g (Pl. XXVc).<sup>23</sup>

### Loom weights

While spindle whorls are usually easily recognisable as such in the archaeological material, this is a much more difficult task with regard to possible loom weights. Cylindrical objects with two and three lengthwise perforations and without perforations, large conical objects, and crescent-shaped objects will be discussed here.

Three elongated **cylinders with two lengthwise perforations** were uncovered in the late EH II layers at Tiryns (Pl. XXVd). Probably they originated from a residential building R 181-186. Two sub-types of this class can be recognised at Tiryns: the first one is c. 10 cm long, the other is slightly shorter (c. 6-7 cm). Both sub-types have diameters of c. 5 cm and the perforations c. 0.8-1 cm diameters. The weight of these objects varies between c. 200 and 330 g. The cylinders were made of pinkish-beige sandy clay; their surface was smoothed, but not painted or slipped. Their quality is rather poor, their shapes are irregular, the perforations are placed off-centre and they were not well fired. Cylinders with two perforations seem to have been most common at EH sites,<sup>24</sup> in contrast to cylinders with one<sup>25</sup> or three perforations.

20 See e.g. CARINGTON SMITH (*supra* n. 19) 675-685; RAHMSTORF (*supra* n. 2) 27-28, fig. 11-12.

21 E.g. at Ag. Kosmas: G.E. MYLONAS, *Aghios Kosmas. An Early Bronze Age Settlement and Cemetery in Attica* (1959) 30, 34, 38, 41, 45, 146, fig. 170 (2-12); Asea: E.J. HOLMBERG, *The Swedish Excavations at Asea in Arcadia* (1944) 118-119, fig. 113 (6-7); Eutresis: H. GOLDMAN, *Excavations at Eutresis in Boeotia* (1931) 192, fig. 265 (2-7), J.L. CASKEY and E.G. CASKEY, "The Earliest Settlements at Eutresis. Supplementary Excavations, 1958," *Hesperia* 29 (1960) pl. 53 (II.48, III.22-23, IV.23-26, VIII.64, VIII.68-70); Kolonna on Aegina: H. WALTER and F. FELTEN, *Alt-Agina Vol. III, 1. Die vorgeschichtliche Stadt. Befestigungen. Häuser. Funde* (1981) 142, 144, 177-178, fig. 134 (476, 478, 480-483), pl. 126 (476, 478, 480-483); Korakou: C.W. BLEGEN, *Korakou. A Prehistoric Settlement near Corinth* (1921) 104, fig. 129 (1-2); Lerna: BANKS (*supra* n. 19) 523-541, pl. 16 (convex conical: 1250, 1238); Lithares: H. TZAVELLA-EVJEN, *Λιθαρές* (1984) 173, fig. 23β-δ, ζ-η, 24α, 25 α-β, δ, ζ-θ, pl. 90, 91α, γ-ε; Zygouries: C.W. BLEGEN, *Zygouries. A Prehistoric Settlement in the Valley of Cleonae* (1928) 190-191, fig. 179; cf. also CARINGTON SMITH (*supra* n. 19) 682.

22 Five bone whorls possibly originated from Mycenae, while two others were found on the lower citadel at Tiryns. RAHMSTORF (*supra* n. 2) 209.

23 Similar objects were reported from the Neolithic and EH sites, e.g. from Zygouries: BLEGEN (*supra* n. 21) 191-192, fig. 181 a; a whorl from Zygouries has a diameter of 5.5 cm, height of 2.2 cm and a central perforation bored from both sides; Kolonna on Aegina: a polished bone spindle whorl had a diameter of 3.9 cm and height of 1.9 cm. WALTER and FELTEN (*supra* n. 21), 142, 177, pl. 126 (477), fig. 134 (477); Lerna: BANKS (*supra* n. 19) pl. 13 (whorls – type a). On the Neolithic and Chalcolithic objects see G. STRATOULI, *Knochenartefakte aus dem Neolithikum und Chalkolithikum Nordgriechenlands* (1998) 166-168, fig. 13 (8).

24 Unbaked or slightly baked cylinders with two longitudinal perforations were discovered among others at Korakou: BLEGEN (*supra* n. 21) 104, fig. 129 (4-5); Lithares: TZAVELLA-EVJEN (*supra* n. 21) 173, fig. 24 θ, 25ι-λ, pl. 91ζ, θ, ι; Orchomenos: H. SCHLIEMANN, *Orchomenos. Bericht über meine Ausgrabungen im böotischen Orchomenos* (1881) 35; Tiryns: SCHLIEMANN (*supra* n. 4) 165-166, fig. 71; Zygouries: BLEGEN (*supra* n. 21) 191; Lerna: BANKS (*supra* n. 19) 565-566, pl. 19 (weights: a, c); Kolonna on Aegina: WALTER and FELTEN (*supra* n. 21) 96, 102, pl. 126 (489-493).

25 Cylinders with one lengthwise perforation were found at Eutresis: GOLDMAN (*supra* n. 21) 193, fig. 266 (3,



**Cylinders with three lengthwise perforations** date to the transitional phase EH II/III. Several examples were grouped in Room 143 of large complex R 142-144 (see above). Other fragments were found in a lower layer (late EH II), but it cannot be ruled out that all objects were used in one loom. They are all fragmented, in several cases only small pieces survived. A single object has three lengthwise perforations preserved at one end (Pl. XXVe).<sup>26</sup> Other fragments look very alike as far as their material, mode of production and shape are concerned, therefore it can be suggested that they belonged to the same type with three perforations. The objects are of cylindrical shape, the perforations are placed asymmetrically and relatively close to the centre of the oval ends. The objects were up to 10 cm long, the diameters measured over 7 cm, diameters of perforations were 0.7-0.9 cm. The reconstructed weight of these objects is 600-650 g. Their quality was poor; they were made of rough clay of characteristic dark brown-reddish colour. Surfaces were only slightly smoothed, and no traces of paint or slip were observed. All examples bear traces of intensive burning (blackened inner and outer surfaces) after they have been damaged and broken. According to my knowledge, no large cylinders with three lengthwise perforations have been reported from other EH sites. The purpose of the weights is not clear to us. They look similar to the cylinders with one and two perforations, typical for the EH II period and usually interpreted as loom weights (see above). It would be interesting to undertake experiments to verify whether they indeed could have been used as loom weights.

Another group of terracotta objects from Tiryns comprise **short cylinders without perforations** (Pl. XXVf). They are sometimes called spools, but in the case of the EH examples from Tiryns their sides are not concave.<sup>27</sup> They were common during various periods,<sup>28</sup> they are also known from other EH sites.<sup>29</sup> At Tiryns their date is not clear: they may have originated from EH II or transitional phase EH II/III. The only four examples discovered until now were found in a group, which suggests that they were used or at least deposited together. The cylinders were c. 6-7 cm long, and had exactly the same diameters (4.8 cm). The weight of the best preserved artefact is 160 g., while the reconstructed weight of the larger one would be up to 175 g. All objects were made of very sandy brownish clay and were probably only lightly fired. The manufacture quality is poor and the shapes irregular. Their similar characteristics (shape, measurements, material) suggest that they were manufactured and used together, possibly forming part of a set of loom weights. The experiments conducted by the CTR demonstrated that such cylinders are well suited as loom weights in a warp-weighted loom.<sup>30</sup> Unfired spools of similar thicknesses (4.5 cm and 5.5. cm), but different weights (105 and 280 g) were tested. They required a very thin yarn, which can be spun with very light spindle whorls of 8 or even

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- 6) and at Lerna: BANKS (*supra* n. 19) 566, 569, pl. 19 (weights: b).
- 26 A clay cylinder with three perforations preserved at one end: LXII 39/47 VI a gez.
- 27 The objects are rather cylindrical than spool-shaped. Spools, i.e. objects with visibly concave side profile, pierced or unpierced, are known from other EH sites, e.g. Lerna: BANKS (*supra* n. 19) 551-554, 560, 563-565, pl. 19 (spools: b); Berbati: G. SÄFLUND, *Excavations at Berbati 1936-1937* (1965) 127; Zygouries: BLEGEN (*supra* n. 21) 190-191, Fig. 179: 4-5; Asea: HOLMBERG (*supra* n. 21) 120-122 Fig. 114 (17); Eutresis: GOLDMAN (*supra* n. 21) 193, fig. 266 (2); CASKEY and CASKEY (*supra* n. 21) 158, pl. 53 (IX.3); Kolonna: WALTER and FELTEN (*supra* n. 21) 178, pl. 126 (488). In the EH layers at Tiryns such spools have not so far been identified.
- 28 RAHMSTORF (*supra* n. 2) 63, footnote 205, fig. 27; cf. ID., "Clay Spools from Tiryns and Other Contemporary Sites. An Indication of Foreign Influence in LH III C?," in N. KYPARISSI-APOSTOLIKA and M. PAPA-KONSTANTINOY (eds), *Η Περιφέρεια του Μυκηναϊκού Κόσμου. Β' Διεθνές Διεπιστημονικό Συμπόσιο/The Periphery of the Mycenaean World. 2<sup>nd</sup> International Interdisciplinary Colloquium. Lamia 26-30.9.1999* (2003) 400; ID., "Ethnicity and Changes in Weaving Technology in Cyprus and the Eastern Mediterranean in the 12<sup>th</sup> Century BC," in V. KARAGEORGHIS, H. MATTHÄUS, and S. ROGGE (eds), *Cyprus: Religion and society from the Late Bronze Age to the end of the Archaic period. Proceedings of the international symposium on Cypriote Archaeology, Erlangen, 23-24 July 2004* (2005) 161, Appendix 1. See also RAHMSTORF, SIENNICKA and ANDERSSON (*supra* n. \*) for further references.
- 29 Cylinders from rough clay without perforation, analogous to those from Tiryns came to light e.g. at Kolonna: WALTER and FELTEN (*supra* n. 21) 178, pl. 126 (489-493), and possibly at Lithares: TZAVELLA-EVJEN (*supra* n. 21) 174.
- 30 L. MÅRTENSSON *et al.*, *Technical Report. Experimental Archaeology. Part 4 Spools, 2007. Tools and Textiles – Texts and Contexts Research Programme. The Danish National Research Foundation's Centre for Textile Research (CTR). University of Copenhagen* ([http://ctr.hum.ku.dk/research/tools/Technical\\_report\\_4\\_experimental\\_archaeology.PDF/](http://ctr.hum.ku.dk/research/tools/Technical_report_4_experimental_archaeology.PDF/) [3 August 2011]), 15.

4 g.<sup>31</sup> There are almost no such whorls identified in EH Tiryns. Perhaps the spindle whorls used for spinning thin yarns were made of wood or bone, and are not preserved. The fabrics produced with the use of such spools would be rather open, perhaps suitable for personal clothes.<sup>32</sup>

Another type of possible loom weights unique for the Argolid are **large cones** (Pl. XXVg), so far reported only from north Greece.<sup>33</sup> Five fragments are preserved at Tiryns, all in bad condition. The cones have straight, uneven sides and flat oval bases. The clay of grey-beige colour was coarse and included many organic and mineral inclusions. The surface was smoothed and unpainted. Only in one case a horizontal perforation was preserved at c. 2/3 of the height (the diameter of the perforation was 1.2-1.3 cm). Because of similarly estimated sizes, the slope of the sides and material it can be assumed that other fragments belonged to the same conical type with a transverse perforation. The best preserved example is 10.5 cm high, however, originally it must have been even larger. Its diameter measured 11 cm, while the reconstructed weight is 800 g. The function of the objects is unclear. They were probably some kind of weights, perhaps used in a warp-weighted loom, however, experiments would be necessary to prove this hypothesis. If the conical objects were indeed loom weights, they probably used very thick yarns, while the produced fabric would be very coarse. Because of the thickness (or diameter) of the objects the fabric would be open.<sup>34</sup>

Because of their unique shape<sup>35</sup> and controversial function, **nine crescent-shaped items** (Pl. XXVh) are possibly the most interesting objects discussed here. They came to light in mixed contexts of various areas on the lower citadel. It seems that most of them date to EH III, however, possibly at least three examples are earlier (late EH II and transitional EH II/III). The objects were a maximum of 16-17 cm long, and c. 5-6 cm thick (they are elliptical in section). At both ends horizontal perforations were placed symmetrically. Only two examples from Tiryns are preserved completely or almost completely: one of them weights 592 g, another c. 460 g. Thus at least two different types of weights are represented at Tiryns. Interestingly, the distance between the perforations in both well preserved examples was identical and measured 13 cm. The well-formed crescent-shaped objects were made of coarse clay of brownish-red or

31 MÅRTENSSON *et al.* (*supra* n. 30) 4-7, 12.

32 MÅRTENSSON *et al.* (*supra* n. 30) 9-11, 13-15.

33 Mostly medium-sized or large pyramidal, oblong, pear-shaped and truncated loom weights have been found in Greece e.g. at Servia: J. CARINGTON SMITH, "The Small Finds: Clay Spinning and Weaving Implements," in C. RIDLEY, K.A. WARDLE, and C.A. MOULD, *Servia I: Anglo-Hellenic Rescue Excavations 1971-73 directed by Katerina Rhomiopoulou and Cressida Ridley* (BSA Suppl. Vol. 32, 2000) 233-236, fig. 4.36 (SF 92, SF340, SF 238, SF 399, SF 301), pl. 4.20 (b); Kastanas in Macedonia: ASLANIS (*supra* n. 14) 197, pl. 11 (5-12), pl. 83 (1-3), and Pefkakia Magoula in Thessaly: J. MARAN, *Die mittlere Bronzezeit. Die Deutschen Ausgrabungen auf der Pevkakia-Magoula in Thessalien III* (1992) 388, pl. 155 (9-10); E. CHRISTMANN, *Die frühe Bronzezeit. Die Deutschen Ausgrabungen auf der Pevkakia-Magoula in Thessalien II* (1996) 315, pl. 163 (8-9). They are known also from Anatolia, e.g. Troy: BLEGEN *et al.* (*supra* n. 14) 338, 353, pl. 369 (loom weights), and Demircihüyük: J. OBLADEN-KAUDER, "Die Kleinfunde aus Ton, Knochen und Metall," in M. KORFMANN (ed.), *Demircihüyük. Die Ergebnisse der Ausgrabungen 1975-1978. Volume IV. Die Kleinfunde* (1996) 238, fig. 165 (I-V), pl. 96-98 (esp. Pl. 98: 6). In contrast to the examples from Tiryns, the looms weights from the mentioned sites are more trapezoidal or flattened than conical, with mostly rectangular or irregular bases.

34 Cf. L. MÅRTENSSON, M.-L. NOSCH, and E. ANDERSSON STRAND, "Shape of Things: Understanding a Loom Weight", *OJA* (2009) 390.

35 Only two crescent-shaped objects (except Tiryns examples) are known up to the present from the Aegean: one was found very recently at EH Geraki in Laconia: J. CROUWEL, M. PRENT, D.G.J. SHIPLEY, "Geraki. An Acropolis Site in Lakonia. Preliminary Report on the Thirteenth Season (2007)," *Pharos* 15 (2007) 6-9, fig. 4, pl. II; and another one at EBA Thermi on Lesbos: W. LAMB, *Excavations at Thermi in Lesbos* (1936) 159, pl. XXIV (31.61). Both examples resemble rather the Near Eastern objects. The presence of the crescent-shaped items in the Aegean possibly points to the cultural influence of Anatolia on the Aegean during late EH II and beginning of EH III (cf. L. RAHMSTORF, "Zur Ausbreitung vorderasiatischer Innovationen in die frühbronzezeitliche Ägäis," *PZ* 81 [2006] 49-96, especially p. 50). The objects were common in Bronze Age Anatolia, e.g. EBA Demircihüyük: OBLADEN-KAUDER (*supra* n. 33) 238, fig. 165 (VI), fig. 168, pl. 1; MBA and LBA Kilise Tepe: D. COLLON and D. SYMINGTON, "Miscellaneous clay artefacts," in N. POSTGATE and D. THOMAS (eds), *Excavations at Kilise Tepe 1994-98. From Bronze Age to Byzantine in Western Cilicia* (British Institute at Ankara Monograph No. 30, 2007) 449-468; or LBA Tarsus: H. GOLDMAN, *Excavations at Gözlü Kule, Tarsus. Volume II. Text. From the Neolithic through the Bronze Age* (1956) 319, fig. 441 (11-12).

orange-pink colour. Their surfaces were smoothed and the objects were carefully fired. Clearly they form a homogenous group as far as their shape and material are concerned. They appear to have been manufactured in a similar way. Since no clay analysis has been undertaken until now, it is impossible to say whether they were imported or produced locally. Similar objects are also common in other regions and periods.<sup>36</sup> As Agnete Wisti Lassen has recently suggested, the objects from Demircihüyük function well as loom weights, and are well suited for twill and patterned weaving.<sup>37</sup> Since at Tiryns they cannot be associated with a particular *locus*, nor they were found in a large group, their purpose as loom weights can be only suggested through comparisons with other sites, as well as through experiments.

The last group of objects which can be associated with textile production are **circular objects with perforations** (Pl. XXVi). Some of them are intentionally rounded potsherds. Such items were common in the EH and other periods.<sup>38</sup> Their purpose has been discussed many times.<sup>39</sup> It can be suggested that light and carefully shaped pieces with centrally placed perforations were used as spindle whorls,<sup>40</sup> while the heavier ones could have been loom weights. Up to the present, only several rounded potsherds could be identified at Tiryns, however, it can be assumed that many are still to be found in the excavation's magazine. The known examples have diameters of 5-10 cm, thickness of 0.7-1.7 cm, weights between 20 g and 180 g, diameters of perforation are 0.6-1 cm. Since the pierced discs were mostly made of potsherds, their quality, colour and surface treatment depended on the quality and decoration of the original vessels. They were shaped with a tool to achieve a round outline. The perforations were made from both sides with a drill. Besides rounded potsherds, there is one flat handmade clay disc with perforation from the EH layers. It was preserved only fragmentarily; its maximal diameter was 4.3 cm, thickness 1.0 cm, calculated weight 17 g (preserved weight 9 g).<sup>41</sup>

- 36 Similar crescent-shaped clay objects are known from Late Neolithic and Copper Age sites in south-east Europe: N. URSULESCU, "Sur la signification fonctionnelle des pièces semi-lunaires en argile de la civilisation de Cucuteni," *Studia Antiqua et Archaeologica (Iasi)* 3-4 (1997) 75-82; Italy: M. BAIONI, M.A. BORRELLO, A. FELDTKELLER and H. SCHLICHThERLE, "I pesi reniformi e le fusaiole piatte decorate della Cultura della Lagozza. Cronologia, distribuzione geografica e sperimentazioni," in M. BAZZANELLA, A. MAYR, L. MOSER and A. RAST-EICHER (eds), *Textiles, intrecci e tessuti dalla preistoria europea (Catalogo della mostra, Museo Civico di Riva del Garda - La Rocca, 24 maggio-19 ottobre 2003)* (2003) 99-109; and Central Europe: A. KRENN-LEEB, "Eine trichterbecherzeitliche Grube mit nierenförmigen Webgewichten von Spielberg bei Melk, Niederösterreich," *Preistoria Alpina* 37 (2001) 118-139. The examples from these sites date from the later 5<sup>th</sup> to the middle of the 4<sup>th</sup> millennium BC. Their much earlier date in regard to Aegean and Anatolian Bronze Age examples makes any genuine relationship seem unlikely.
- 37 A. W. LASSEN, "Weaving with Crescent Shaped Loom Weights," in: ANDERSSON and NOSCH (*supra* n. \*); ID., *Weaving with Crescent Shaped Loom Weights* (2007). I would like to thank Agnete Wisti Lassen for providing me with a copy of her unpublished report. Others have argued that these objects were in some way connected with administration because many of the Anatolian items bear stamp seals impressions: J. WEINGARTEN, "The Sealing Structure of Karahöyük and Some Administrative Links with Phaistos on Crete," *OA* 29 (1990) 63-95; G.M. VOGELANG-EASTWOOD, "Crescent Loomweights?," *OA* 29 (1990) 99-113. Nevertheless, several of the crescent-shaped objects from EBA Demircihüyük were found together with pyramidal loom weights (total 29 examples) which clearly demonstrates their joint use on a warp-weighted loom: M. KORFMANN, *Demircihüyük. Die Ergebnisse der Ausgrabungen 1975-1978. Volume I. Architektur, Stratigraphie und Befunde* (1981) 33-34, fig. 45. Also at Tarsus, LBA I crescent-shaped objects were found together with a pyramidal loom weight: GOLDMAN (*supra* n. 35) 319.
- 38 Pierced and unpierced rounded potsherds are known e.g. from Aghios Kosmas: MYLONAS (*supra* n. 21) 146, Fig. 174; Asea: HOLMBERG (*supra* n. 21) 119, fig. 113 (14); Asine: O. FRÖDIN and A. W. PERSSON, *Asine. Results of the Swedish Excavations 1922-1930* (1938) 253, fig. 177 (5); Lithares: TZAVELLA-EVJEN (*supra* n. 21) 173-174, pl. 92 α-π); Nichoria: CARINGTON SMITH (*supra* n. 19) 680 (table 11-2). They are common also at many Mycenaean sites, also at Tiryns: RAHMSTORF (*supra* n. 2) 37-52.
- 39 Mylonas (*supra* n. 21) 146 suggested that the discoid objects (clay discs, perforated or imperforated rounded pot sherds) served as loom weights or stoppers for jars, and the hole would have been to "secure them safely on top of the pots." See also CARINGTON SMITH (*supra* n. 33) 207-214, fig. 4.31, pl. 4.17; RAHMSTORF (*supra* n. 2) 49-52.
- 40 For a different opinion see: *Textile Tools from Tiryns. Technical Textile Tools Reports (CTR)* ([http://ctr.hum.ku.dk/research/tools/Technical\\_report\\_4\\_experimental\\_archaeology.PDF/](http://ctr.hum.ku.dk/research/tools/Technical_report_4_experimental_archaeology.PDF/) [3 August 2011]) 8.
- 41 Similar discs deliberately made of clay, but not of potsherds, were discovered at Zygouries: BLEGEN (*supra* n. 21) 190, fig. 179 (9, 15); Eutresis: GOLDMAN (*supra* n. 21) 95, 192, fig. 120; Aghios Kosmas: MYLONAS (*supra* n. 21) 146; and possibly at Asea: HOLMBERG (*supra* n. 21) 119, fig. 113 (9-11).



## Textile production in Tiryns

On the basis of the presented potential textile tools from EH Tiryns, it is possible to make some general observations about the thickness of yarns produced by large and heavy spindle whorls, as well as about the fabrics possibly produced using loom weights of various masses.

From the experiments and tests – among others made by the CTR<sup>42</sup> – it is obvious that the weight of a spindle whorl affects the finished product, i.e. the spun yarn. Generally speaking, the heavier the spindle whorl, the thicker and coarser the thread will be.<sup>43</sup> The relation between weight and diameter of a spindle whorl also affects the twist angle: with a light spindle whorl with a large diameter the thread will be twisted harder, which also affects the quality of the fabric. The EH spindle whorls at Tiryns are heavy; they weigh between 30 and 120 g. This suggests that the spun yarns were thick and coarse. On the other hand, the large spindle whorls were suitable for doubling or plying, i.e. twisting two or more threads together to form a stronger yarn. A plied yarn could be used in making heavy clothes, blankets, rugs, sacks or cord.<sup>44</sup> Thinner yarns could have possibly been produced at Tiryns if we assume that lighter whorls were used, e.g. made of rounded potsherds, bone or unpreserved wood.

The various thicknesses of produced yarns obviously required different weight tension of the yarns when used on a warp-weighted loom. It is assumed that the thicker the thread, the more tension is needed. E.g. a yarn spun with a 44 g spindle whorl needs approximately 40 g tension. The heavier the loom weight, the more warp threads can be attached to each loom weight. Also the thickness of the loom weights is important when weaving. If one wants to produce an open fabric using thick yarn, the weaver would use heavy and thick loom weights. If a dense coarse fabric is to be made, the loom weights should be heavy and thin. Light and thin loom weights and fine yarn will produce a dense fabric.<sup>45</sup> In EH Tiryns we are dealing with various masses (between 175 g to almost 800 g) of loom weights, but at the present we are not able to ascribe particular types to the particular phases of the EH period. The variety of loom weights suggests that a range of fabric types were produced at Tiryns. Possibly different classes of tools were favourable for various types of weaves, as has recently been suggested for the crescent-shaped objects suitable for twills and patterned weaves.<sup>46</sup>

A serious difficulty regards a correlation between the spindle whorls and loom weights discovered at Tiryns as far as the thickness of spun yarns are concerned, and the fabrics that could have been produced with the use of the loom weights. Nevertheless, it seems that the produced fabrics were generally coarse and thick. They may have been outdoor cloth or rugs. Everyday cloth and other fabrics could have been produced with a use of lighter spindle whorls and lighter loom weights (e.g. pierced discs or unbaked cylinders without perforations).

## Wool or flax?

The last issue to be addressed concerns the types of fibres used in EH Tiryns, whether plant or animal fibres – or perhaps both types – were employed. At present this question can be answered only to some extent with regard to botanical and zoological remains from Tiryns and other sites in Greece, as well as the types of textile tools employed during the EH period.

Evidence of flax cultivation in north Greece was demonstrated e.g. at Servia in Macedonia already for the Early and Middle Neolithic period<sup>47</sup> and at Olynthus in the Early-Middle Bronze

42 The CTR's reports from experiments on textile tools from various sites in Greece and the Near East are available on the CTR's webpage: <http://ctr.hum.ku.dk/research/tools/> (3 August 2011).

43 E.g. *Textile Tools from Tiryns. Technical Textile Tools Reports (CTR)* ([http://ctr.hum.ku.dk/research/tools/Technical\\_report\\_4\\_experimental\\_archaeology.PDF/](http://ctr.hum.ku.dk/research/tools/Technical_report_4_experimental_archaeology.PDF/) [3 August 2011]) 8, fig. 11.

44 CARINGTON SMITH (*supra* n. 19) 680.

45 MÅRTENSSON, NOSCH, and ANDERSSON STRAND (*supra* n. 34) 390.

46 LASSEN (*supra* n. 37) 3.

47 R.N.L. HUBBARD, "Appendix 2: Ancient Agriculture and Ecology at Servia," in M. WIJNEN *et al.*, "Rescue Excavations at Servia 1971-1973: A Preliminary Report," *BSA* 74 (1979) 227; R.A. HOUSLEY, "The Environment and Agriculture: the Carbonised Plant Remains," in RIDLEY, WARDLE, and MOULD (*supra* n. 33) 293, 302, 314, 323, fig. 5.4 a, table 5.3, table 5.10.



Age.<sup>48</sup> At Lerna in the Argolid, the seeds of flax were preserved in layers dated to the EH II period.<sup>49</sup> Almost no evidence has been found at Tiryns of flax use during the EH or even the Mycenaean period. Only one of the 8222 samples collected in 117 areas of the site containing flax was dated to LH IIIB2.<sup>50</sup> However, it should be taken into consideration that if the plant was cultivated mostly for fibre and not for oil-bearing seeds this may explain the almost entire lack of seeds in the archaeobotanical material. If used for fibre, the plant was harvested before the seeds were ripe, therefore they would not be necessarily present in the material.<sup>51</sup> It is well known from the Linear B texts from Pylos and Knossos that flax was spun by the Mycenaeans and linen textile production was an important industry in the Palatial period.<sup>52</sup> This could also be true for Mycenaean Tiryns, even if almost no evidence of flax use is preserved. Moreover, there are indications that linen fabrics were woven in Greece already during the Neolithic and Early Bronze Age periods. At Kephala on Keos negative impressions of fine fabrics, probably linen, were uncovered in the walls of the Late Neolithic coarse vessels.<sup>53</sup> Similar impressions were preserved on clay sealings from the EH site at Geraki in Laconia.<sup>54</sup> Until now no such evidence has been recognized in Tiryns.

As far as the use of wool is concerned, it is estimated that the development of sheep with long-staple wool (fleece) was not completed before the Bronze Age.<sup>55</sup> During the Early Bronze Age, larger sheep with a better quality and quantity of wool appeared in the Aegean,<sup>56</sup> as has been suggested on the basis of evidence for example from sites in Thessaly and north-east Greece.<sup>57</sup> Unfortunately, from the archaeozoological data from EH Tiryns it is impossible

- 48 H.J. KROLL, *Kastanas. Ausgrabungen in einem Siedlungshügel der Bronze- und Eisenzeit Makedoniens 1975-1979. Die Pflanzenfunde* (1983) 56-58; C. BECKER and H. KROLL, *Das prähistorische Olynth. Ausgrabungen in der Tomba Agios Mamas 1994-1996. Ernährung und Rohstoffnutzung im Wandel* (2008), 33-34, 154-156, fig. 9.
- 49 M. HOPF, "Nutzpflanzen vom Lernäischen Golf," *JRGZM* 9 (1962) 4, 6.
- 50 H. KROLL, "Kulturpflanzen von Tiryns," *AA* (1982) 479, table 2; for the lack of flax in the LH IIIC strata in the Lower Town North-East see also R. PASTERNAK, "Bericht zu den archäobotanischen Funden aus Stadt-Nordost," in J. MARAN and A. PAPADIMITRIOU, *Forschungen im Stadtgebiet von Tiryns 1999-2002*, *AA* (2006) table 1.
- 51 A.L.H. ROBKin, "The Agricultural Year, the Commodity SA and the Linen Industry of Mycenaean Pylos," *AJA* 83 (1979) 470; *Prehistoric Textiles*, 12.
- 52 J. CHADWICK, *Documents in Mycenaean Greek* (1973) 131, 295-301, 413, 468-471; ROBKin (*supra* n. 51) 469-474; *Prehistoric Textiles*, 312; I. TZACHILI, *Υφαντική και υφάντρες στο Προϊστορικό Αιγαίο 2000-1000 π.Χ.* (1997) 68-77; P. HALSTEAD, "Mycenaean Wheat, Flax and Sheep," in S. VOUTSAKI and J. KILLEN (eds), *Economy and Politics in the Mycenaean Palace States. Proceedings of a Conference held on 1-3 July 1999 in the Faculty of Classics, Cambridge* (2001) 44-46.
- 53 Fine cloth built into the walls was probably supposed to strengthen the vessels. There is no direct evidence that the fabric was made of linen or wool, however, according to J. Carington Smith at least in one case linen was more probable: J. CARINGTON SMITH, "Cloth and Mat Impressions," in J.E. COLEMAN (ed.), *Keos I: Kephala, a Late Neolithic Settlement and Cemetery* (1977) 82, 93, 114-118, pl. 90: 167, 201, 213; cf. TZACHILI (*supra* n. 53) 68.
- 54 G. VOGELSANG-EASTWOOD, "The Textile Impressions from Geraki," in J. WEINGARTEN *et al.*, *Early Helladic Sealings from Geraki in Lakonia, Greece*, *OJA* (1999), 371-374, fig. 20-22; J. WEINGARTEN, "Early Helladic II Sealings from Geraki in Lakonia: Evidence for Property, Textile Manufacture, and Trade," in W. MÜLLER (ed.), *Minoisch-mykenische Glyptik: Stil, Ikonographie, Funktion. V. Internationales Siegel-Symposium. Marburg, 23.-25. September 1999* (CMS Beiheft 6, 2000) 321-322, fig. 9-10.
- 55 M.L. RYDER, "Changes in the Fleece of Domesticated Sheep," in P.J. UCKO and G.W. DIMBLEBY, *The Domestication and Exploitation of Plants and animals* (1969) 500; ID., "A Re-assessment of Bronze Age Wool," *JAS* 10 (1983) 327-331; ID., *Sheep and Man* (1983) 45-49, 67-68; TZACHILI (*supra* n. 52) 38; N. BENECKE, *Der Mensch und seine Haustiere. Die Geschichte einer jahrtausendealten Beziehung* (1994) 136-139.
- 56 M.L. RYDER, "Sheep," in I.L. MASON (ed.), *Evolution of Domesticated Animals* (1984) 68; A. VON DEN DRIESCH, "Haus- und Jagdtiere im vorgeschichtlichen Thessalien," *PZ* 62 (1987) 15-16, fig. 6; C. BECKER, *Kastanas. Ausgrabungen in einem Siedlungshügel der Bronze- und Eisenzeit Makedoniens 1975-1979. Die Tierknochenfunde* (1986) 51; *Prehistoric Textiles*, 35; BENECKE (*supra* n. 55) 137-138; MARAN (*supra* n. 1) 243.
- 57 J. BOESSNECK, "Die Funde des Vollneolithikums und der Bronzezeit," in V. MILOJČIĆ, J. BOESSNECK, and M. HOPF, *Die Deutschen Ausgrabungen auf der Argissa-Magula in Thessalien I. Das präkeramische Neolithikum sowie die Tier- und Pflanzenreste* (1962) 46-47; S. BÖKÖNYI, "Faunal Remains," in C. RENFREW, M. GIMBUTAS, and E.S. ELSTER, *Excavations at Sitagroi. A Prehistoric Village in Northeast Greece. Vol. 1* (1986) 79-80, table 5.7; BECKER (*supra* n. 56) 51-57; VON DEN DRIESCH (*supra* n. 56) 15-16, fig. 6; C. BECKER, "Die Tierknochenfunde von der Platia Magoula Zakrou – neue Untersuchung zu Haustierhaltung, Jagd und Rohstoffverwendung im neolithisch-bronzezeitlichen Thessalien," *PZ* 66 (1991) 20-21, table 6, fig. 3.

to say whether the fleeced type or another kind of sheep was raised in the EH period<sup>58</sup> and whether animal fibres were predominant in textile production.

## Conclusions

It has been demonstrated that the spindle whorls at EH Tiryns were mainly large and medium, while only several clay objects of smaller dimensions and weights can be associated with spinning (small spindle whorls, circular objects and discs with perforations). According to E.J.W. Barber and J. Carington Smith<sup>59</sup> a long-staple wool and flax required heavy spindle whorls. On the other hand, both types of threads could be spun with lighter spindle whorls, but this supposedly required much more skill.<sup>60</sup> The tests made by the CTR with spinning the flax threads with 8 g whorls demonstrated that a whorl with a larger diameter would be more suitable to spin plant fibres, because it would be more likely to stop the threads from slipping off the spindle. The larger spindle whorls and pierced discs at Tiryns had large diameters which may suggest that they were suitable for spinning flax threads. Nevertheless, smaller whorls were also used in the CTR's tests and they also seemed to work well.<sup>61</sup> Another explanation for the use of heavy spindle whorls is that they were suitable for doubling or plying threads together to form a strong yarn.<sup>62</sup> Because of the lack of preserved yarns, fabrics or impressions of such, or adequate botanical and zoological evidence, it is at the moment impossible to definitely state what kind of threads were spun at EH Tiryns and whether animal or plant fibres were predominant in textile production.<sup>63</sup> The range of very heavy looms weights of several shapes at Tiryns may also suggest that fabrics were woven from various types of yarns. The yarns could be of diverse stage of coarseness, and made both of plant and animal fibres. Probably, various looms weights were needed to weave different types of fabrics from a variety of yarns.<sup>64</sup> The identification of types of fibres awaits new discoveries – preferably finds of textile fragments or impressions of fabrics on vessels or sealings.

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58 A. VON DEN DRIESCH and J. BOESSNECK, "Die Tierreste von den mykenischen Burg Tiryns bei Nauplion," in J. WEISSHAAR *et al.*, *Tiryns. Forschungen und Berichte* XI (1990) 100-101, 120-121, diagram 7. On the problem with the identification of whether sheep had a woolly or hairy coat on the basis of the animals' bones see also BECKER, KROLL (*supra* n. 48) 124-125.

59 *Prehistoric Textiles*, 52; CARINGTON SMITH (*supra* n. 33) 217.

60 CARINGTON SMITH (*supra* n. 19) 680; L. MÅRTENSSON *et al.*, *Technical Report. Experimental Archaeology. Part 2:1 Flax, 2006. Tools and Textiles – Texts and Contexts Research Programme. The Danish National Research Foundation's Centre for Textile Research (CTR). University of Copenhagen* (2006) ([http://ctr.hum.ku.dk/research/tools/Technical\\_report\\_4\\_experimental\\_archaeology.PDF/](http://ctr.hum.ku.dk/research/tools/Technical_report_4_experimental_archaeology.PDF/) [3 August 2011]) 16.

61 MÅRTENSSON *et al.* (*supra* n. 60) 11-12.

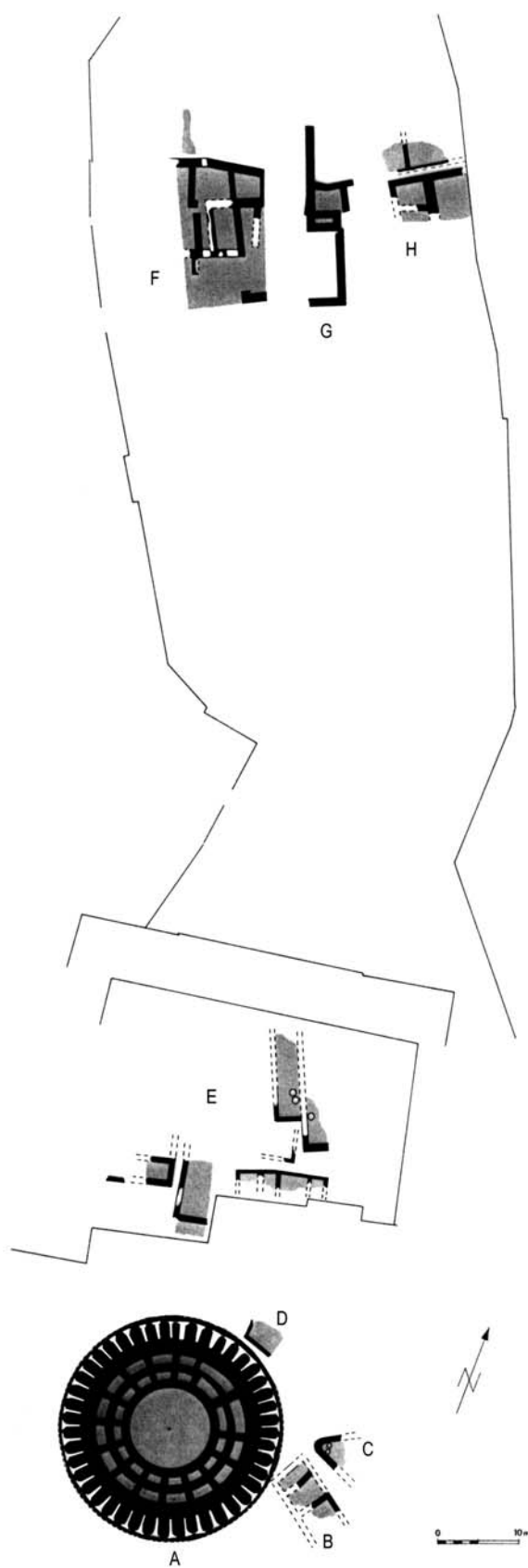
62 CARINGTON SMITH (*supra* n. 19) 680.

63 Cf. TZACHILI (*supra* n. 52) 41.

64 The CTR's experiments demonstrated that as far as the textile tools are concerned there is no essential difference in weaving yarns spun from plant or animal fibres with the same types of loom weight sets. MÅRTENSSON *et al.* (*supra* n. 60) 14-16.

## LIST OF ILLUSTRATIONS

- Pl. XXIV     The acropolis at Tiryns in the Early Helladic period (horizon 7): A – Circular Building (*Rundbau*), B-D – buildings on the upper acropolis, E – buildings on the middle acropolis, F – R 181-186, G – building, H – R 197-198, 205-206 (by courtesy of the German Archaeological Institute at Athens).
- Pl. XXVa     EH large clay spindle whorl (scale 1:2).
- Pl. XXVb     EH small clay spindle whorl (scale 1:2).
- Pl. XXVc     EH spindle whorl made of bone (scale 1:2).
- Pl. XXVd     EH clay cylinder with two lengthwise perforations (scale 1:2).
- Pl. XXVe     EH clay cylinder with three lengthwise perforations (scale 1:2).
- Pl. XXVf     EH clay cylinder without perforations (scale 1:2).
- Pl. XXVg     EH large clay cone with a transverse perforation (scale 1:2).
- Pl. XXVh     EH clay crescent-shaped object (scale 1:2).
- Pl. XXVi     EH pierced sherd (scale 1:2).

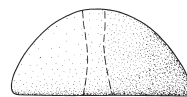




a



b



c



d



e



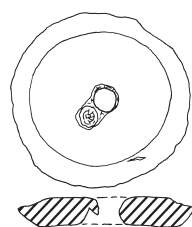
f



g



h



i